

PATENT

11564.0050.NPUS01

APPLICATION FOR UNITED STATES LETTERS PATENT

for

REMOTE DISTRIBUTION CABINET

by

Robert E. Baker, Michael R. Harper, James K. Martin, Randall F. Mathis

EXPRESS MAIL MAILING LABEL

NUMBER EL 818775992 US

DATE OF DEPOSIT March 1, 2002

I hereby certify that this paper or fee is being deposited with the United States Postal Service "EXPRESS MAIL POST OFFICE TO ADDRESSEE" service under 37 C.F.R. 1.10 on the date indicated above and is addressed to: Assistant Commissioner for Patents, Washington D.C. 20231.

Signature

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of United States Provisional Patent Application Serial No. 60/272,842, filed on March 2, 2001 and having the title "Enclosure Assembly" and naming the same inventors identified herein, which provisional application is hereby incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

The influx of rack equipment in client/server, telecommunications, process control, vibration monitoring, and numerous other electrical and electronic equipment environments has created a need for greater numbers of individual power branch circuits. These devices are smaller than their predecessors, more numerous, densely packed and consume less power. Because of this, most power distribution units expend their circuit breaker poles prior to exceeding their rated capacity. Present solutions to this problem require adding more electrical enclosures housing additional circuit breakers, or building larger, bulkier enclosures capable of housing the requisite additional breakers. As is evident, this requires additional space, expending the space available for additional electrical equipment and/or electronic components.

Available power distribution enclosures have a number of disadvantages that are particularly noticeable when a single enclosure having a large number of branch circuits is required. Prior art power distribution enclosures having a large number of branch circuits typically comprise frame structural cabinet and post members in addition to panel frame members that increase the size of the enclosure and limit the space available for branch circuit panelboards. In addition, the installation of such enclosures in a raised floor environment typically requires that floor tiles be cut to allow cable entry. Such enclosures may also require the entire raised floor tile be removed and the enclosure set on the structural floor beneath causing a gapped space in the raised floor. Conversely, if the enclosure is too large it overlaps to adjacent tiles causing the inability to remove the adjacent tiles if needed. Yet another limitation of prior art designs is the lack of ability for users to have neat, easily accessible, and efficient installations because of numerous wires that extend from the enclosure branch circuits to the space under the raised floor.

SUMMARY OF THE INVENTION

1
2 The present invention is directed to a remote distribution cabinet, which
3 overcomes the design and installation limitations of prior art power distribution
4 enclosures. In one embodiment of the present invention, the remote distribution cabinet
5 uses structural members and internal panelboard components as the frame assembly.
6 This design contains fewer structural components than prior art designs, and thereby
7 allows the remote distribution center to house, for example, 168 branch circuit devices
8 (the equivalent of four full panelboards) in a relatively small area. Moreover, having
9 fewer structural components requires less welding during assembly resulting in simplified
10 and less costly remote distribution cabinet construction.

11 Unlike prior art remote distribution cabinets, a remote distribution cabinet in
12 accordance with the present invention includes no isolation transformer, which helps to
13 minimize the space required by the remote distribution cabinet. By separating the
14 transformer from the panelboard function, a remote distribution cabinet in accordance
15 with the present invention may be extremely compact, so that it will fit within the area of
16 a standard 24-inch raised-floor tile while still permitting removal of adjacent floor tiles.

17 For strength, the structural members can be ribbed and/or made of a myriad of
18 materials having various strengths. The structural members can be a substantially solid
19 sheet or have a substantial opening allowing access to the electrical equipment and/or any
20 associated wiring. The remote distribution cabinet can also include covers surrounding
21 the structural members, with at least one cover being a door providing access to the
22 branch circuit devices.

23 In one embodiment, the remote distribution cabinet is designed to fit into the
24 space of a standard 2 ft. x 2 ft. (600mm x 600mm) raised floor tile, which allows adjacent
25 tiles to be removed without disturbing the enclosure. In this design, the bottom member
26 of the remote distribution cabinet can replace the raised floor tile. Moreover, the bottom
27 member includes a void space, eliminating the need to cut raised floor tiles for cable
28 entry. In addition, this remote distribution cabinet design eliminates tripping hazards
29 created by gap spaces in the raised floor caused by users removing entire tiles to set the
30 enclosure on the structural floor beneath. Further, the remote distribution cabinet may
31 include a junction box that is beneath the floor and attached to the remote distribution

1 cabinet bottom member, thereby allowing users to terminate input and output cables in
2 the junction box for a more efficient installation.

3 Despite its small size, a remote distribution cabinet in accordance with the present
4 invention, has increased accessibility. Accessibility is provided by the use of inline 42-
5 pole panelboards with wide access channels. Up to four panelboards are separated into
6 vertical compartments with individual hinged access covers. Any compartment can be
7 serviced without exposing the wiring of the other three panelboards.

8 Additionally, the conduit landing place at the base of a remote distribution cabinet
9 in accordance with the present invention may feature up to 168 holes. Additionally, the
10 holes in the first row may be over-punched from 1/2-inch to 3/4-inch without interfering
11 with adjacent holes.

12 The remote distribution cabinet may also feature clear insert panels to allow
13 inspection of the circuit breakers without opening the cabinet, tie breakers to allow the
14 internal panelboards to be connected to different inputs, and adjustable accent panels to
15 compensate for breaker creep.

16 In yet another aspect of a remote distribution cabinet in accordance with the
17 present invention, the individual panelboards within the enclosure may receive power
18 from different sources, which enables the remote distribution cabinet to provide fault-
19 tolerant, fully maintainable dual-bus power. A power distribution cabinet in accordance
20 with the present invention may also be configured as a dual input unit. Such a unit is
21 constructed with two panelboards on each side sharing common input terminals.

22 A remote distribution cabinet in accordance with the present invention may also
23 include a current monitoring panel for monitoring the currents in each panelboard.

24 In yet another aspect of the present invention, the internal panel may be formed
25 using a DIN rail assembly, wherein the branch circuit devices are mounted on DIN rails,
26 and the structural members are affixed to the DIN rail assembly to form the rigid
27 structural frame.

28 BRIEF DESCRIPTION OF THE DRAWINGS

29 Figure 1 shows a remote distribution cabinet in accordance with the present
30 invention with a door, outer side cover, and junction box attached.
31

1 Figure 2 shows a remote distribution cabinet in accordance with the present
2 invention with the door removed and the outer side cover attached.

3 Figure 3 illustrates the internal structural components of a remote distribution
4 cabinet in accordance with the present invention.

5 Figure 4 shows detail of the main circuit breakers ventilation and support
6 attachments.

7 Figure 5 illustrates frame members of a remote distribution cabinet in accordance
8 with the present invention.

9 Figure 6 illustrates a single-tiled junction box attached to the bottom member of a
10 remote distribution cabinet in accordance with the present invention.

11 Figure 7 illustrates detail of the internal panels of a remote distribution cabinet in
12 accordance with the present invention.

13 Figure 8 illustrates internal structural components of a remote distribution cabinet
14 including a DIN rail assembly in accordance with the present invention.

15 Figure 9 illustrates a front view of the interior of a remote distribution cabinet in
16 accordance with the present invention.

17 Figure 10 illustrates a front view of a remote distribution cabinet having hinged
18 panelboard accent covers.

19 While the present invention is susceptible to various modifications and alternative
20 forms, specific embodiments are shown by way of example in the drawings and are
21 described in detail herein. However, it should be understood that the invention is not
22 limited to the particular forms disclosed. Rather, the invention includes all modifications,
23 equivalents, and alternatives within the scope of the appended claims.

24 DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

25 The outer portion of a remote distribution cabinet in accordance with the present
26 invention is illustrated in Figure 1. The remote distribution cabinet includes a door 27,
27 door latch 41, side member cover 6, a screened protective top 1, and a doubled-tile size
28 junction box 30 beneath the raised floor 32 and attached to the bottom member (see Fig.
29 2) of the remote distribution cabinet. Also illustrated in Figure 1 are a number of branch
30 circuit breakers 40. As shown, these circuit breakers 40 are operable without the need to
31

1 open the enclosure door 27. However, it can be appreciated that a clear insert panel or
2 cover (not shown) can be added for viewing of circuit breaker 40 positions without
3 opening the cabinet. Such a cover may be made of Plexiglas® material or a similar
4 transparent material.

5 Figure 2 illustrates a remote distribution cabinet in accordance with the present
6 invention with the door removed and the outer side cover 6 attached. The remote
7 distribution cabinet includes a screened protective top 1, main panel circuit breakers 2,
8 commercial panelboards 4 (e.g. Square D type) having a plurality of circuit breakers 40,
9 side member cover 6, conduit panel 3, having holes 43, and bottom member 23 with a
10 void portion 42. The bottom member including an outer edge portion for placement on a
11 raised floor 32 as depicted in Figure 1. The void 42 of bottom member 23 allows wiring
12 to pass from a raised floor 32 through the conduit panel holes 43 to the panelboards 4.
13 The conduit panel 3 can be made of three inserts having a total of 168 holes 43 - some
14 that may be over-punched to diameters of 3/4-inch without interfering with adjacent
15 conduit panel holes 43. The plurality of conduit panel holes 43 allow matching of the
16 size and number of cable/conduit openings for varying end user requirements and to
17 provide for a neater more efficient installation. The enclosure also includes isolated
18 neutral and safety-ground bus bars 48.

19 The internal structural and device components of a remote distribution cabinet in
20 accordance with the present invention are illustrated in Figure 3. Structural members 14
21 represent part of the remote distribution cabinet frame and comprise a single sheet of
22 galvanized steel with ribs 17 and 13 to provide a strong substructure. The structural
23 members 14 are designed with a plurality of connection holes 29 for attachment of
24 various components including the screened protective top 1, internal panels 15 (see Fig.
25 7), and main panel circuit breaker 2 support and ventilation attachment 18 (see Fig. 4).
26 Attachment of the enclosure components may be by any fastening means, such as screws,
27 pins, connectors or rivets placed within the structural member connection holes 29 and
28 the corresponding connection holes on the various components. The structural members
29 14 are also designed with lances 12, which hold the conduit panel 3 inserts in place and
30 connector openings 11, which attach side member cover 6 (see Fig. 2) to structural
31 members 14. The structural members 14 also include opening 46, which allows access to

1 the panelboard 4 as well as any associated wiring. While Figure 3 shows the structural
2 members 14 having an opening 46, structural members 14 may also be substantially solid
3 members, especially in applications where only rear access to the remote distribution
4 cabinet internal wiring or components is needed.

5 More details of internal panels 15 are shown in Figure 7. The internal panels 15
6 may be made of painted steel, galvanized steel, aluminum or other suitable materials.
7 Moreover, for added strength the internal panels 15 can include ribs (not shown).
8 Panelboards 4 having circuit breakers 40 are attached to the internal panels 15 via
9 connectors, screws, pins or rivets. Structural members 14 are affixed to internal panel 15
10 by placing a fastener through internal panel 15 connector holes 45 into structural member
11 14 connector holes 29 (see Fig. 3).

12 The present invention overcomes the deficiencies of the prior art in that the
13 attachment of structural members 14 to internal panel 15 and panelboard 4 forms the
14 frame structure of the remote distribution cabinet, to which bottom member 23 (see Fig.
15 2) is attached. This design incorporates the internal panels 15 and panelboard 4 into the
16 frame structure and eliminates the need for post or cabinet members that are found in
17 typical enclosures. Further, this design requires less welding than typical enclosures
18 during construction. Moreover, this construction allows more space, for example,
19 allowing 168 branch circuit breakers 40 in a single floor-tile sized enclosure.

20 Although the enclosure is small in size and has the ability to house 168 branch
21 circuit breakers 40, because of its novel design of using the internal panel and structural
22 members to form the frame assembly it has increased accessibility to the panel
23 components. Referring to Figures 2, 9, and 10 the panelboards 4 have wide access
24 channels and may house up to 42 circuit breakers each. Although only two panelboards 4
25 having a combined total of eighty-four circuit breakers 40 are illustrated, it can be
26 appreciated that an identical configuration of panelboards 4 is located at the rear of the
27 enclosure for a total of four panelboards 4 having a combined total of 168 branch circuit
28 breakers 40. Internal panels 15 (see Fig. 3) include dividers 44, which separate the
29 panelboards 4 into individual vertical compartments. Each panelboard compartment
30 includes isolated neutral and safety-ground bus bars 48. Each panelboard compartment
31 also has a hinged access cover 47 as shown in Figure 10, which allows any individual

1 panelboard 4 to be serviced without exposing the wiring and electrical connections of the
2 other panelboards 4. The hinged accent cover 47 includes mechanical adjustments to
3 allow proper fit over the branch breakers and to compensate for breaker creep.

4 Figure 4 shows detail of the ventilation and support attachments 18 for the main
5 panel circuit breakers 2. The main panel circuit breaker 2 ventilation and support
6 attachments 18 are mounted to structural members 14 (see Fig. 3) via connection holes 35
7 and the structural member 14 connection holes 29. Ventilation and support attachments
8 18 aid in the natural convection cooling of the enclosure and the screened protective top 1
9 (see Fig. 2) assists in heat rejection.

10 Each main panel circuit breaker 2 is electrically connected to an individual
11 panelboard 4, allowing the panelboards 4 to receive power from different sources,
12 providing fault-tolerant, fully maintainable dual-bus power. This design also enables
13 service to one panelboard 4 without requiring the removal of power from the other
14 panelboards 4. Although each panelboard 4 can receive power from different sources, tie
15 breakers (not shown) can also be installed to allow the panelboards 4 to be connected to
16 different power inputs. While Figure 4 depicts four (4) main panel circuit breakers 2, it
17 should be appreciated that a single input or dual input enclosure can be configured, the
18 dual input configured with two panelboards 4 sharing common input terminals or main
19 panel circuit breakers 2. In addition to the multiple power input configurations, the
20 enclosure may also include a current monitoring panel for monitoring the phase and
21 neutral currents for each panelboard.

22 The bottom member 23 is attached to structural members 14 and is illustrated in
23 Figure 5. The bottom member 23 has a void 42 to allow cabling to enter the remote
24 distribution cabinet. In one embodiment, bottom member 23 is also constructed with an
25 outer edge that fits into the tile space opening of a 2 ft. x 2 ft. (600mm x 600mm) raised
26 floor, replacing the tile. Another aspect in which a remote distribution cabinet
27 constructed in accordance with the present invention overcomes the limitations of prior
28 art is that bottom member 23 allows the user to replace tiles in raised flooring with the
29 enclosure, which allows adjacent tiles to be removed without disturbing the remote
30 distribution cabinet. Use of bottom member 23 also eliminates the need for cutting tiles
31 for cable entry. This design also eliminates the necessity of removing tiles and placing

1 the remote distribution cabinet directly on the floor creating gapped spaces and tripping
2 hazards.

3 A remote distribution cabinet in accordance with the present invention may also
4 include a doubled-tile size junction box 30 or a single-tile junction box 31 attached to
5 bottom member 23, which are illustrated in Figure 1 and Figure 6 respectively. The
6 junction boxes 30 and 31 being beneath the raised floor 32 and having terminal strips 33
7 and conduit and cable knockouts 34 allow the user to terminate wiring for more efficient
8 installations. Also depicted in Figure 6 is an alternate design of the enclosure that has the
9 one panelboard 60 mounted atop the other rather than the juxtaposed configuration shown
10 in Figure 1.

11 As illustrated in Figure 8, a remote distribution cabinet in accordance with the
12 present invention may also be constructed with an assembly of DIN rails 52 that form an
13 internal member 50 having connector holes 51 to which structural members 14 (see Fig.
14 5) are affixed via structural member connection holes 29. In this embodiment, circuit
15 breakers having DIN rail mounts (not shown) are attached to the DIN rail assembly
16 internal member 50. This design incorporates the DIN rail assembly internal member 50
17 into the frame structure and also eliminates the need for post or cabinet members that are
18 found in prior art remote distribution cabinets.

19 Additional modifications and adaptations of the disclosed embodiment are
20 possible without departing from the scope of the present invention. It is intended that the
21 invention embrace all embodiments within the scope of the following claims.